

Climate change: Possible implications for food safety?

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There is a growing consensus that human activities may be changing our planet's climate. These changes in climate have a number of possible implications for human health and welfare, one of which could be the safety of food.

Background

Since the 18th century, human activities have released large amounts of gases such as carbon dioxide and methane into the atmosphere. The vast majority of these gases have come from the burning of fossil fuels, industrial processes and deforestation.¹ Estimates for release of gases from food systems are between 19-29% based on 2008 data.² The build-up of these gases, known as greenhouse gases, in the atmosphere, traps energy and acts like a blanket around the Earth. While there is a minority view that disagrees, this phenomenon, known as the greenhouse effect, is attributed to causing an increase in the overall temperature of the Earth's atmosphere (i.e. global warming). This warming effect can influence and alter the Earth's climate leading to climate change.^{1,3}

The most recent report from the Intergovernmental Panel on Climate Change (IPCC) has said that the "warming of the climate is unequivocal, human influence is clear, and limiting climate change will require substantial and sustained reductions of greenhouse gas emissions."⁴

Climate change

Climate change is a significant and lasting change to the weather conditions.^{1,3} These changes can lead to more extreme weather events such as stronger storm systems, increased frequency of heavy rain and extended dry periods.³ Rising global temperatures may also result in the melting of polar icecaps, increasing sea-levels, acidification of the oceans, coastal flooding and alteration of ocean currents.^{1,3,4,5,6} Recent IPCC estimates indicate likely temperature rises of 1.5°C or greater for some parts of the world by the end of the 21st century.⁴

Possible implications for food safety

The possible implications of climate change on availability and access to food (i.e. food security) has been widely researched and debated. Climate change is generally seen as having a negative impact on food security, particularly in developing countries.^{3,7,8}

In contrast to food security the possible implications of climate change on food safety is an emerging field of research.⁹ The Emerging Risks Unit of the European Food Safety Authority (EFSA) has identified climate change as a driver for emerging risks in food and feed safety in the mid- or long-term.¹⁰ Improving our

understanding of the possible effects of climate change on food safety is important considering the implications it can have on food security.^{7,11,12}

Below is a brief overview of some potential implications of climate change. Some of these implications are supported by data, others are speculative.

Microbiological issues

The ability of microorganisms (e.g. bacteria, viruses, parasites) to survive and grow is influenced by the environment, including temperature and humidity. Many foodborne pathogens, such as Salmonella and Campylobacter, grow well in warm, moist conditions.^{3,6,9,13,14,15,16,17} In addition, many foodborne diseases also show seasonal changes in prevalence.^{7,13,17,18}

Increases in temperature and humidity and extreme weather conditions will affect the ability of many bacterial foodborne pathogens to survive and/or grow under such conditions.^{3,6,9,13,14,15,16,17} Some of these affects could be positive or negative in terms of food safety i.e. decrease or increase the ability of foodborne pathogens to survive/grow. However, this will depend on the microorganisms' specific requirements for growth/survival and their ability to survive and grow under stressful conditions.³

Climate change may also influence the spread or transmission of foodborne pathogens. For example, warmer temperatures in summer and milder winters may increase the abundance of pests such as insects and rodents which can spread foodborne pathogens.^{3,6,9,13,14,15,16,17} Similarly, excess rainfall leading to flooding may aid the transport of foodborne pathogens onto agricultural crops.¹⁶ Thus, climate change may alter the incidence of foodborne illness and/or the ability of pathogens to cause illness.^{7,13,17,18}

Other potential impacts of climate change include:

- Emergence of new microbial hazards due to changes in the types of crop cultivated and the associated agricultural practices for crops (e.g. increased use of untreated animal waste to fertilise crops).
- Increase in antibiotic-resistant pathogens due to greater use of veterinary medicines in farm animals.^{3,6} Antimicrobial resistance may be caused by spontaneous changes in the genetic make-up of a cell, or by the stable incorporation of mobile genetic elements transferred among microorganisms.²⁰

The impact of climate change could be more evident in foodborne pathogens with low-infective doses (i.e. low cell numbers will cause illness) as small changes in their numbers or distribution could lead to an increase in foodborne illness.³

Chemical issues

Changes in the nature, level and transmission of various chemicals, contaminants and toxins may affect the

safety of our foods.¹⁸ Climate change may affect agricultural practices. What crops are grown and how they are grown will change in different countries.⁷ The type and abundance of pests (e.g. insects and rodents) and weeds will change. This may change the type, level and use of chemicals (e.g. pesticides) and fertilisers on crops. However, the use of chemicals on crops in Europe is tightly regulated and monitored to ensure the safety of these foods.^{3,12,16}

Toxins such as mycotoxins are formed by some fungi as they grow on crops. They can be consumed through contaminated crops or indirectly through animal products (e.g. meat or milk from animals) that have eaten contaminated feed. The production of these toxins may be affected by temperature and moisture conditions.¹⁶ For example, the Emerging Risks Unit of EFSA has identified changing patterns in mycotoxin contamination in cereal crops such as wheat, maize and rice.²¹

Mycotoxins can cause a wide range of toxic effects in both animal and humans. Some of the most common mycotoxins are carcinogenic, genotoxic, or may target specific organs in the body such as the kidney or liver.²²

Increases in ocean temperatures may also impact the growth of dangerous algae that can produce marine biotoxins which can concentrate in shellfish, e.g. mussels and clams and some fish used for food production, and could cause human illness if consumed.⁷ A recent outbreak of ciguatera poisoning (which can occur following ingestion of some species of fish, where plankton may produce ciguatoxin, accumulating in the flesh of the fish who have consumed it) associated with consumption of contaminated fish was reported in the Canary Islands with at least 10 people affected.²³

Is Europe ready for such possible impacts of climate change on food safety?

The safety of food in Europe is amongst the highest in the world and is controlled by an extensive legislative system coupled with food monitoring, enforcement and scientific research. This provides consumers with continued protection against existing and emerging food safety issues which may be associated with climate change.⁹

The tolerated levels of some microbiological and chemical contaminants and toxins are established at European level through detailed legislation. Therefore, the systems of control are already in place to protect consumers. Additionally the European food safety infrastructure also provides the scope to adapt to the emerging challenges.²⁴

Conclusions and the future

It is impossible to accurately assess the full impact of climate change on food safety. However, it is likely that some effect on microbiological and chemical hazards will be seen. The extent of the risk posed by these hazards will depend on the type of hazard and the local conditions and practices.¹⁸

As our current knowledge of the risks posed by climate change on food safety is incomplete, there is



uncertainty.³ Hence there is a need to ensure that the food safety infrastructure currently in place across Europe is not only maintained but reviewed and improved. This will require continued investment in surveillance and monitoring of our foods coupled with risk assessment, management and communication.